Quantification and Analysis of Development in Whatcom County 1990-2010

Conducted By : Alex Machin-Mayes Spring 2012

Following World War II, suburban development rapidly gained momentum throughout the United States. Economic prosperity, population expansion, and the construction of the Interstate Highway System shook loose the demographic structure of American cities with newfound mobility. Simultaneously, social decline in urban areas and the diffusion of governmental incentives for automobile centered development merged with these changes and fueled a mass-movement of Americans out of the central cities towards the urban periphery (Kaplan, *et al.* 2009).

These processes compounded with an emerging cultural preference for maximized private spaces and molded suburban development in the latter half of the 20th century; projecting the single family subdivision as the ideal form of development in post-war America. However, these sprawling low-density developments have impacted the American landscape; consuming agricultural lands and open spaces, producing aesthetic and environmental pollution, and leaving behind underutilized declining areas within the urban environment. These issues necessitate a reevaluation of traditional development principles and the formulation of carefully considered strategies for future planning (Platt, 2004).

The objective of this study was to quantify changes in development densities from 1990 to 2010 within the western region of Whatcom County, Washington State (Map 1) and to create a foundational framework for analyzing urban sprawl. Understanding a region's historical and current development patterns is critical to making informed decisions about issues such as land use planning, public service expansion, environmental conservation, and commercial development. Analyzing growth trends can help planners and decision makers logically prepare for long term population changes rather than dictate their reaction to the effects. This study addressed four central questions:

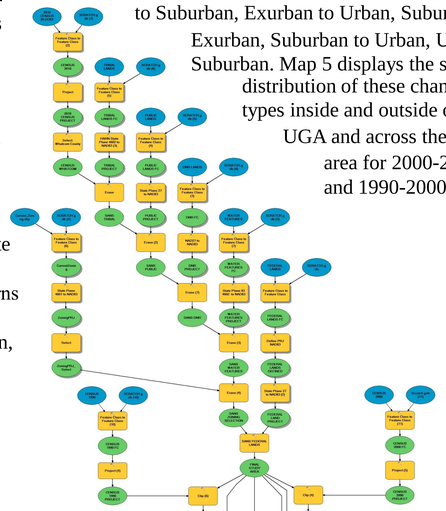
1. How much change occurred in Whatcom County between 1990 and 2010?

2. What proportion of this growth can be qualified as urban, suburban, exurban, and rural?

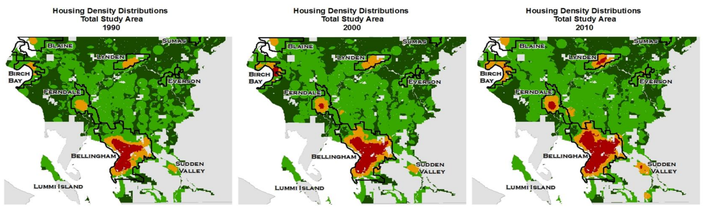
3. What have been the patterns of change inside and outside of the UGA?

4. What kinds of development transitions are currently taking place Whatcom County?

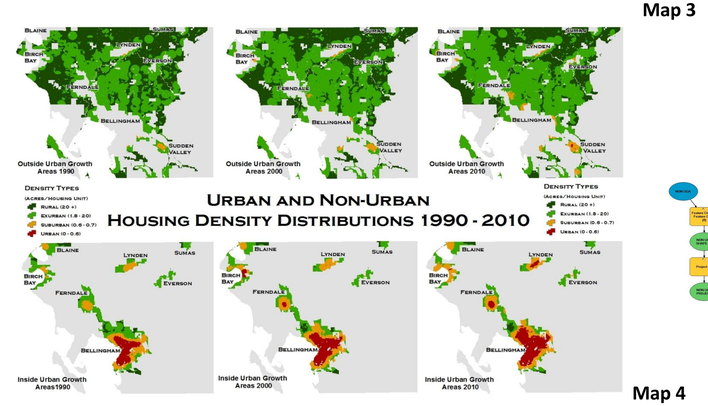
Locations and quantities of change were calculated using the ArcGIS **Raster Calculator** and a change matrix. Areas of specific change-types were identified and calculated for the total study area as well as the UGA and non-UGA regions. These change-types included: Rural to Exurban, Rural to Suburban, Exurban to Rural, Exurban to Suburban, Exurban to Urban, Suburban to Exurban, Suburban to Urban, Urban to Suburban. Map 5 displays the spatial distribution of these change-types inside and outside of the UGA and across the study area for 2000-2010 and 1990-2000.



Model 1. Workflow



Map 3



Map 4

	Total Area 1990-2000
To Urban	8 %
To Suburban	16 %
Rural to Exurban	57 %

	Total Area 2000-2010
To Urban	9 %
To Suburban	20 %
Rural to Exurban	50 %

	Non UGA 1990-2000
To Urban	0 %
To Suburban	6 %
Rural to Exurban	73 %

	Non UGA 2000-2010
To Urban	0 %
To Suburban	12 %
Rural to Exurban	65 %

	In UGA 1990-2000
To Urban	29 %
To Suburban	50 %
Rural to Exurban	14 %

	In UGA 2000-2010
To Urban	35 %
To Suburban	45 %
Rural to Exurban	9 %

Proportions of Total Change
(Change from lower density to higher density)

Table 5. *Total Study Area*

Housing Densities:	Urban	SubUrban	ExUrban	Rural
Change 1990-2000	3078	3910	9882	-15731
Change 2000-2010	2509	3802	4550	-11168
Total Change 1990-2010	5587	7712	14432	-26899

Change in Acres of Housing Density

Table 6. *Outside UGA*

Housing Densities:	Urban	SubUrban	ExUrban	Rural
Change 1990-2000	32	1357	13978	-14970
Change 2000-2010	64	2534	7578	-10598
Total Change 1990-2010	96	3891	21555	-25568

Change in Acres of Housing Density

Table 7. *Inside UGA*

Housing Densities:	Urban	SubUrban	ExUrban	Rural
Change 1990-2000	3046	2554	-4314	-1242
Change 2000-2010	2445	1254	-3072	-518
Total Change 1990-2010	5491	3808	-7386	-1760

Change in Acres of Housing Density

Concentric density increases were seen in the UGA from suburban to urban and exurban to suburban around the perimeter of Bellingham, Ferndale, and Birch Bay during both the 1990-2000 and 2000-2010 periods (Map 5). Outside of the UGA, the trend was rural to exurban density transitions. In the 1990-2000 period 22,253 acres of rural land changed to rural densities and in the 2000-2010 period 15,315 acres made the same transition (Table 6).

The final result was the calculation of proportions of change across the study area, inside the UGA and outside of the UGA (Table 8). This study indicates that rural to exurban transitions were the dominant proportion of change outside of the UGA and across the study area in both periods, making up 57% of the change that occurred during the 1990-2000 period and 50% of change from 2000-2010.

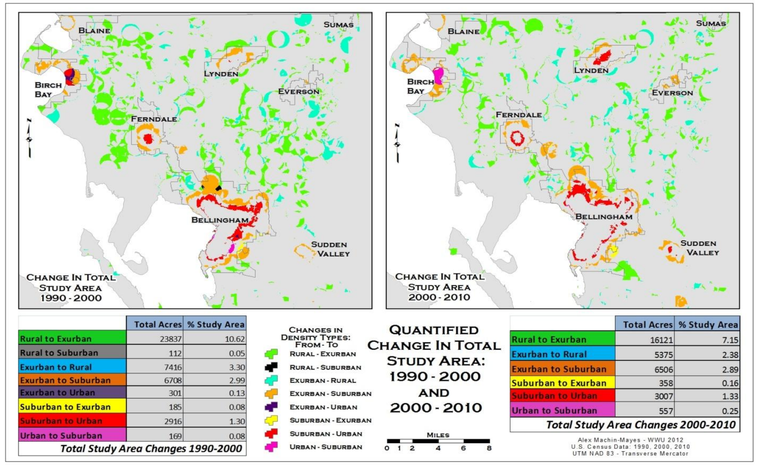
Changes to suburban densities within the UGA were significant, comprising 50% of change within the UGA from 1990-2000 and 45% from 2000-2010. There was also a large proportion of change to urban densities within the UGA, counting for 29% and 35% of change within the UGA during the 1990-2000 and 2000-2010 periods respectively.

Patterns and Future Growth

The results of this study indicate that the primary patterns of change in Whatcom County from 1990-2010 have been the transition from rural to exurban densities outside the UGA and from suburban to urban densities inside the UGA. This was true during both census periods and coincided with significant decreases in rural areas adjacent to exurban areas. These specific change-types are likely related to the study area's existing state of development. Direct transitions from rural and exurban densities to urban density would not be the anticipated pattern for a low population, low density area. Rather, a pattern of transitional phases from one density type to the next over time would be expected. (Kaplan, 2009). This transitional pattern was observed in the proportion of change that took place inside the urban growth areas. Inside the UGA density levels were already higher than rural levels making transitions from rural to exurban densities minimal. Instead, the change in suburban density was the most significant, followed by changes in urban density.

A subtle but important result of this study is shown in Table 8. The proportions of change that dominated throughout the study period show declines from 2000 to 2010. As developing areas become more concentrated, previously large transitions from one type slow while the next increases. Outside of the UGA, proportions of change that were exurban slowed from 73% to 65% of the change area, while at the same time the next highest density level (suburban) increased from 6% to 12% of the change area. This pattern was also seen inside the UGA with a decrease in the proportion of change to suburban (50% to 45%) and an increase in the proportion of change to urban (29% to 35%) between census periods. This could indicate that a broader transition is taking place where suburban density increases begin to dominate non-urban areas and urban densities fill in the UGA.

The changes within urban areas shown in this study were aligned with historical patterns of urban growth in the United States. Suburban to urban density changes were the most dominant during both time periods followed by changes from exurban to suburban development. The broad pattern detected through this study was a tendency for declines in lower density areas to coincide with increases in the next density level. For example, outside the UGA decreases in rural areas corresponded with increases in exurban densities. Areas inside the UGA (already having surpassed rural density) showed decreases in exurban densities corresponding with increases in suburban densities. This change adjacent to urban areas may indicate that suburban areas are becoming more urban. Likewise, rural densities decreasing adjacent to exurban areas may be indicative of exurban transitions. This concentric pattern of development is consistent with growth patterns surrounding urban population centers. As densities increase populations and development spill out of urban centers causing exurban areas to experience growth. This has been the spatiotemporal pattern of modern urbanization in the United States.



	Total Acres	% Study Area
Rural to Exurban	23837	10.62
Rural to Suburban	112	0.05
Exurban to Rural	7416	3.30
Exurban to Suburban	6708	2.99
Exurban to Urban	301	0.13
Suburban to Exurban	185	0.08
Suburban to Urban	2916	1.30
Urban to Suburban	169	0.08
Total Study Area Changes 1990-2000		

Quantified Change In Total Study Area: 1990 - 2000 AND 2000 - 2010

	Total Acres	% Study Area
Rural to Exurban	16121	7.15
Exurban to Rural	5375	2.38
Exurban to Suburban	6506	2.89
Suburban to Exurban	358	0.16
Suburban to Urban	3007	1.33
Urban to Suburban	557	0.25
Total Study Area Changes 2000-2010		

Map 8. Quantified change -types.